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REDUCTION OF SAWDUST IN SAWMILL OPERATIONS

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REDUCTION OF SAWDUST

IN SAWMILL OPERATIONS

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REDUCTION OF SAWDUST

IN SAWMILL OPERATIONS

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Whitney, Ontario

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Report prepared for:

Program Development Branch
Ontario Ministry of Environment and Energy

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REDUCTION OF SAWDUST IN SAWMILL OPERATIONS
Thin-Kerf, Twin-Circular Guided Headsaw
Pilot Project

Final Report

by

A.P. Kostiuk and J.H. Pleau

prepared for

ONTARIO MINISTRY OF ENVIRONMENT AND ENERGY
135 St. Clair Avenue West, Suite 100
Toronto, Ontario
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October 1994

Contract Number 3785K926

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DISCLAIMER

This report was prepared for the Ontario Ministry of Environment and Energy (formerly Ministry of the Environment) as part of a Ministry funded project. The views and ideas expressed in this report are those of the author and do not necessarily reflect the views and policies of the Ministry of Environment and Energy, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

SUMMARY

The ability to reduce waste sawdust production by using Forintek's patented circular headsaw guide and thinner kerf saws was demonstrated in a twin-circular sawmill. The McRae Mills Ltd. twin-circular sawmill in Whitney, Ontario diverted 7,250 green tonnes annually from sawdust production to valuable pulp chips. Sawdust production decreased by 58% and product value increased by $192,000/year. Bark production also decreased 34%, which represents about 2,854 green tonnes/year.

Approximately 29% reductions in sawdust and bark production were due to reductions in resource consumption. The rest of the decrease in sawdust production was due to thinner headsaw kerf. Before the pilot project, headsaw kerf at the McRae mill ranged from 0.285 to 0.320 inch. After the conversion to thin-kerf guided saws, a kerf of 0.220 inch was used when logs were not frozen and a kerf of 0.250 inch was used when logs were frozen. Headsaw kerf was therefore successfully reduced by more than 19%.

McRae Mills Ltd. modified the original proposal to upgrade and retrofit their existing twin-circular scragg with saw guides and thinner kerf saws. They ended up commissioning North American Sawmill Machinery (1977) Ltd. to completely replace their headsaw with a new twin-circular, incorporating an end-dogging overhead carriage. The end-dogging carriage enabled sawlogs to be held more securely during sawing. This is very important when using thin-kerf high-tension saws. The end-dogging carriage also greatly increased the manufacturing flexibility of the sawmill, by allowing multiple passes at the headrig.

Forintek Canada Corp. licensed North American Sawmill Machinery (1977) Ltd. to manufacture its patented circular headsaw guide, so that it could be incorporated into the headsaw they designed for McRae Mills Ltd. Forintek provided technical advice during construction of the new headrig. At the startup inspection, Forintek made recommendations to improve North American Sawmill Machinery's end-dogging headrig design (Appendix 1). Budget contraints limited the ability of McRae Mills and North American Sawmill Machinery to accommodate Forintek's recommendations at the McRae installation. However, the pilot project provided North American Sawmill Machinery (1977) Ltd. with valuable expertise in constructing their first end-dogging twin-circular headsaw and recommendations for improving their design in future installations.

In addition to specific equipment improvement recommendations, Forintek wrote and published a technical and maintenance handbook for thin-kerf circular sawmills, plus a guide and checklist to help the licensee evaluate the commitment of other mill candidates for thin-kerf circular headsaw technology. The precision requirements and checklist will help the licensee interpret whether other interested sawmills are serious about providing the funds and employee training required to upgrade and maintain equipment precision to the levels necessary to make a thin-kerf circular headsaw conversion successful. The thin-kerf technical and maintenance handbook provides filer and millwright information which will help both the licensee and other sawmills properly design, install and maintain thin-kerf guided circular headsaws.

These equipment and information enhancements should help the licensee provide the complete thin-kerf conversion package needed to encourage widespread conversions to thin-kerf circular headsaw technology.

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1.0 MANDATE

This project was undertaken by McRae Mills Ltd. with funding provided by the Ontario Ministry of Environment and Energy, under the Industrial Waste Diversion Program. Forintek Canada Corp. was a subcontractor to McRae Mills Ltd.

2.0 OBJECTIVES

To demonstrate the ability of Forintek's patented circular headsaw guide to reduce waste sawdust production in twin-circular sawmills.

To identify any enhancements needed to enable an Ontario equipment supplier to deliver a complete retrofit package which will encourage widespread sawmill conversions to thin-kerf circular headsaws.

3.0 BACKGROUND

Only about 80 of the largest Ontario sawmills use bandsaws or chipping headrigs to minimize waste sawdust production. Approximately 600 to 650 Ontario sawmills still use thick-kerf circular headsaws with inserted teeth as the main piece of lumber manufacturing equipment. These headsaws typically have saw kerfs of 0.280 to 0.350 inch. They convert 9% to 15% of the valuable log volume into a sawdust liability. Thick-kerf circular headsaws inefficiently deplete Ontario's forest resources. They also create a waste disposal problem. Circular headsaws produce more than 175,000 tonnes of waste sawdust annually, which ends up in landfills or incinerators.

Circular headsaws are used mainly by small to medium hardwood and softwood sawmills, or as small-log lines in large sawmills. Lumber production generally averages less than 5 million board feet annually per line, which is inadequate to economically justify replacing existing circular headsaws with thinner kerf bandsaws. Process heat and electricity demands by small sawmills are not sufficient to provide a reasonable payback on residue-fired energy systems. Cooperative utilization of sawdust from hundreds of small isolated sawmills is also economically impractical. To divert sawdust from disposal, Ontario's circular sawmills need an inexpensive method of reducing sawdust production.

Forintek has developed a prototype saw guide to enable circular headrigs to be inexpensively retrofitted with saws having kerfs of only 0.160 to 0.200 inch. A patent has been obtained and a prototype guide has been tested on a circular headsaw and carriage in a Quebec hardwood sawmill. Under research conditions, headsaw kerf and sawdust production were reduced 40%. An industrial pilot project is now needed to test, demonstrate and commercialize this circular headsaw guide.

The small and medium sawmills in Ontario that this saw guide can help have been historically slow to invest in new technology. These mills are frequently family-owned business lacking financial and human resources to adapt new technology to their operation. This sector of the lumber manufacturing industry needs a complete thin-kerf retrofit package, including identification and provision of any additional equipment modifications and services that may be required. Additional equipment requirements may include improvement to log infeed systems, different filling room equipment, or a sawlog feed speed controller. Services may include machine alignment, improved mill maintenance schedules and training of sawyers, filers and millwrights.

A pilot project is required to identify what exactly is needed to encourage widespread sawmill implementation of thin-kerf circular headsaws. It is also needed to evaluate the appropriateness of training and licensing an Ontario equipment supplier to do future sawmill conversions.

4.0 PROJECT PERSONNEL

Alan Kostiuk, B.Sc. F.	Project Leader Research Scientist-Wood Processing
Julien Pleau	Sawmill Technical Advisor
Ghislain Veilleux	Sawmill Process Technologist

5.0 APPROACH

McRae Mills Ltd., a hardwood sawmill located in Whitney Ontario, requested Forintek to adapt thin-kerf guided saws to their twin-circular headsaw. This pilot project was to adapt and modify the prototype guide into a commercial application; overcome engineering complications due to space restrictions for guides on twinsaws; evaluate improvements necessary to twinsaw log feed systems, saw maintenance and machine alignment; and evaluate whether thinner saws necessitate slower sawing rates and/or feedspeed control systems.

Forintek was to lead the pilot project, provide technical support, assist in commissioning the guides, plus provide training to sawfilers, sawyers and millwrights. An Ontario sawmill equipment supplier was to be subcontracted to retrofit the mill with saw guides and thin-kerf saws. Forintek was to evaluate the appropriateness of licensing and training this Ontario firm to do future sawmill conversions, including provision of the supplementary services and mill training performed by Forintek during the pilot project.

The pilot project was also expected to identify improvements to thin-kerf guided circular saw technology which would increase the number of Ontario sawmills that can readily benefit. One enhancement envisaged is the need to regulate sawlog feed rate based on the depth of cut. It will be important to maximize sawing rate, yet provide protection against overfeeding, reduced sawing accuracy and the threat of dangerous saw break-up. By automating feed speed control, thin-kerf saws could be used by sawmills with less experienced sawyers, without the need for specialized training. The pilot project will help to determine the need for future research, development and additional demonstrations to incorporate enhancements, but enhancements will not be developed as part of this pilot project.

6.0 RESULTS

6.1 CHANGES FROM ORIGINAL PROPOSED APPROACH

McRae Mills Ltd. decided to go beyond the original plan to merely upgrade and retrofit and their circular scragg with Forintek saw guides, thin-kerf saws, improved hold-down feed rolls, etc., as proposed in the Industrial Waste Diversion Program application form. They decided to contract North American Sawmills Machinery (1977) Ltd. of Killaloe, Ontario to design, manufacture and install a new twin-circular headsaw, with an end-dogging overhead carriage.

The modified approach maintained the primary project objective of demonstrating the ability of Forintek's saw guide to enable use of significantly thinner saws on twin-circular headrigs. However, by adding an end-dogging carriage, it enabled logs to be held firmer during sawing. The addition of an end-dogging overhead carriage also added manufacturing flexibility for McRae Mills Ltd. It created a headsaw with multiple pass capabilities. The original plan to retrofit the existing scragg would have limited the system to a single pass system, capable of only 2 cuts per log.

The improved approach also better addressed the secondary project objective of identifying enhancements needed to enable an Ontario equipment supplier to deliver a complete retrofit package which will encourage widespread sawmill conversions to thin-kerf circular headsaws. The project enabled North American Sawmills Machinery (1977) Ltd. to develop expertise in manufacturing a multiple-pass twin-circular headrig. This improved their ability to meet the needs of a broader scope of Ontario circular sawmills.

Forintek licensed North American Sawmills Machinery (1977) Ltd. to manufacture and install its patented circular headsaw guide. Forintek also provided technical assistance to North American Sawmills Machinery (1977) Ltd. during construction of the new headrig.

The improved end-dogging headsaw increased pilot project expenditures above the $ 81,805 originally proposed in the Industrial Waste Diversion Program application. It also lengthened the schedule for the capital works project. We understand costs were of the order of about $180,000. However, Forintek did not have access to this information. McRae Mills Ltd. dealt directly with North American Sawmills Machinery (1977) Ltd.

Forintek inspected the thin-kerf, twin-circular headrig at startup, in March 1993. Verbal recommendations to improve operating conditions were provided to both McRae Mills Ltd. and North American Sawmills Machinery (1977) Ltd. Budgetary constraints limited the ability of McRae Mills and North American Sawmill Machinery to accommodate Forintek's recommendations. Consequently, Forintek's involvement in monitoring the pilot project ceased, including proposed analysis of sawlog feed rates. To avoid similar problems in future installations, Forintek's verbal recommendations were documented internally (Appendix 1). This final report has been prepared by Forintek with information provided by McRae Mills Ltd. in May 1994.

6.2 KERF REDUCTIONS

The pilot project achieved the primary objective of demonstrating the ability of Forintek's patented saw guide to enable use of significantly thinner saws in this twin-circular application.

Before this pilot project, McRae Mills Ltd. used saw-tooth widths ranging from 0.285" to 0.320". As proposed in Section 3.1 of the Industrial Waste Diversion Program application, kerf reduction was done in phases. Inserted-tooth saws with an average saw-tooth width of 0.285 inch were used for start-up of the new twin-circular that incorporated Forintek saw guides. Later, the width of inserted teeth was reduced to 0.250 inch, representing a kerf reduction of 12%. Then carbide-tipped, solid-tooth saws were tried. They had an average tooth width of 0.220 inch. These carbide tipped saws achieved a minimum 23% kerf reduction from the original inserted-tooth width, which ranged from 0.285 inch to 0.320 inch.

McRae Mills Ltd. intends to operate with the 0.220-inch carbide-tipped, solid-tooth saws for approximately 8 months of the year. During winter, when logs will often be frozen, inserted-tooth saws with an average tooth width of 0.250 inches will be used. The annual average saw-tooth width will be about 0.230 inch (8/12 x 0.220" + 4/12 x 0.250"). Therefore the Forintek saw guide has enabled a minimum kerf reduction of 19% from the minimum kerf of 0.285 inch, used before conversion. This is conservative, since saws were previously used with kerf as large as 0.320 inch.

6.3 CHANGES IN RESOURCE CONSUMPTION, PRODUCT AND BY-PRODUCT YIELDS

This pilot project resulted in changes in processing methods, which go way beyond kerf reduction. Some of the rationale has been explained in section 6.1. The effects on resource consumption and product yields are enumerated in Table 1.

The new multiple-pass headsaw increased manufacturing flexibility. The original twin circular made one pass to manufacture a 2-sided cant for secondary breakdown into lumber by a bull edger. The new end-dogging twin circular allows poor quality logs to be sawn into large timbers with 2 or more passes at the headrig. This allows the twin-circular mill to saw logs that are shorter and have more defects than previously possible. Productivity of the twin-circular mill decreased and resource consumption dropped by 29% (Table 1). However, it allowed McRae's double-cut bandsaw and carriage sawmill, located on the same site, to be more productive and profitable. By enabling the poor quality logs to be sawn in the twin-circular mill, the band mill can now concentrate on profitable sawing of good quality logs into high quality lumber.

Annual lumber production in the twin-circular mill decreased 52.5%, from 10.6 to 5.0 million board measure (MMBM). Lumber recovery of the new mill is worse than it was with the old mill (15.8% vs. 23.7% by weight; Table 1). This decrease is due to poorer quality logs being sawn.

Chip production decreased only 12.5%. Chip yield, as a percentage of resource consumption by weight, increased from 56.6% to 69.8%.

The new twin-circular headsaw, incorporating Forintek's saw guides, increased the combined yield of the two primary products (lumber and pulp chips) from 80.3% of resource weight to 85.6% of resource weight. By-product yields of sawdust and bark decreased from 19.8% to 14.4% of resource consumption (Table 1).

Table 1 Comparison of Resource Consumption and Product Yield Changes

	Annual Resource Consumption, Product and By-Product Yield					
	Before		After		Change	
	(green tonnes)	(%)	(green tonnes)	(%)	(green tonnes)	(%)
Resource Consumption (including bark)	105,695		75,009		30,686	29.0
Lumber	24,997 (10,582MBM)	23.7	11,865 (5,028MBM)	15.8	13,132 (5,554MBM)	52.5
Pulp Chips	59,808	56.6	52,338	69.8	7,470	12.5
Sawdust	12,500	11.8	5,250	7.0	7,250	58.0
Bark	8,410	8.0	5,556	7.4	2,854	33.9

6.4 WASTE DIVERSION

Bark truly is an unutilized waste at the McRae sawmill. It is incinerated. The 29% reduction in resource consumption, combined with a change in log sizes and qualities, resulted in a 33.9% reduction in bark production. Approximately 2,854 green tonnes less bark is being generated and incinerated annually by the twin-circular mill.

Sawdust is an undesirable low-valued by-product. Whenever possible, it is sold as furnish for a Domtar particleboard plant in Huntsville. The 29% reduction in resource consumption, coupled with kerf reduction in excess of 19%, resulted in approximately a 58% reduction in sawdust production. About 7,250 green tonnes annually has been diverted from low-valued sawdust to higher-valued pulp chips. McRae's market for softwood pulp chips is currently poor, yielding only $1.30/green tonne more than sawdust. But 93% of resource consumed by the twin-circular mill is hardwoods and poplar. Hardwood chip prices exceed sawdust prices by about $28.40/green tonne. The 7,250 green tonnes of sawdust diverted into pulp chips increased product value by about $192,000/year.

6.5 ENHANCEMENTS TO ENCOURAGE WIDESPREAD CONVERSIONS TO THIN-KERF CIRCULAR HEADSAWS

6.5.1 Enhancements to North American Sawmill Machinery (1977) Ltd. Prototype Thin-kerf Guided Circular Twinsaw

This pilot project was already modified, as explained in Section 6.1, to provide the licensee with expertise in manufacturing a twin-circular headsaw with an end-dogging overhead carriage. This improved the ability of North American Sawmill Machinery (1977) Ltd. to supply a more diverse number of twin saw applications. Forintek's recommendations to enhance their initial prototype design have been itemized in the April 5th and 15th, 1993 memoranda in Appendix 1.

6.5.2 Precision Requirement Guidelines

A guide and a checklist have been prepared to help North American Sawmill Machinery (1977) Ltd. differentiate serious candidates for thin-kerf technology from "window shoppers" (Appendices 2 & 3).

Appendix 2 contains a description of the precision requirements necessary to enable successful conversion. This guide could be used by employees of the licensee who have the skills to discuss precision requirements with sawmill owners and interpret their commitment and ability to upgrade and maintain the required precision.

Appendix 3 is a check list of questions which could be used to collect information on mill precision. When completed, this check list will help the licensee consider a sawmill's potential to meet the requirements discussed in Appendix 2. The licensee will want to avoid mills that sound interested in the benefits of thin-kerf guided circular headsaw, but may not be willing to provide the funds and manpower training needed to upgrade and maintain a high level of mill precision.

The check list is not all encompassing. Each mill will have different requirements to upgrade their precision to enable a thin-kerf guided circular headsaw. The guide and check list provided will not replace the skill and experience of Julien Pleau, Sawmill Technical Advisor and inventor of Forintek's patented saw guides. However, they will help licensee employees do preliminary assessments and collect valuable information needed to assess potential thin-kerf candidates and to determine the mill modifications required.

6.5.3 Thin-Kerf Circular Headsaw Mills - A Technical and Maintenance Handbook

A technical and maintenance handbook, with the above mentioned title, has been prepared to provide filer and millwright information on proper maintenance of the thin-kerf headsaw after conversion. It also can be used by the licensee to help mills considering conversion to thin-kerf guided circular headsaws understand the commitment to precision required to make the conversion successful.

The maintenance handbook was prepared by the inventor of Forintek's patented thin-kerf circular headsaw guide, Julien Pleau. It contains over 50 pages of simple instructions, figures and charts on:

- mill foundations; track levelling and alignment, the husk;
- the carriage and its alignment
- saw technology; Forintek saw guide; saw tensioning and levelling; and
- saw tipping and grinding.

The maintenance handbook can be ordered from Forintek's Eastern Laboratory.

7.0 RECOMMENDATIONS FOR OTHER SAWMILLS

McRae Mills Ltd. recommends that other sawmills use Forintek's circular headsaw guides to reduce circular headsaw kerf. They suggest however, that other sawmills concentrate on side grinding inserted-tooth saws to reduce kerf, before attempting to use carbide-tipped saws. Kerf reductions and technology changes should be progressive. By adding a side grinder to the filing room and Forintek's saw guides to the headsaw, inserted-tooth thickness can be reduced from over 0.300 inch to about 0.240 inch, without the added implications of immediately switching to carbide-tipped saws. Once the inserted-tooth saws work well, then saw tipping and tensioning equipment can be added to the file room to obtain the additonal kerf reductions and improved sawing accuracy possible by carbide-tipped saws. McRae Mills believes that they converted too quickly and were overly ambitious, starting with carbide-tipped saw-tooth widths of only 0.200 inch.

McRae Mills also recommended that carbide-tipped saws with frost teeth (spike in the gullet) be used for sawing hardwoods. Regular gullets worked fine when sawing softwoods, but the frost tooth removed sawdust better when sawing hardwoods.

APPENDIX 1

RECOMMENDATIONS TO IMPROVE

McRAE MILLS LTD.

THIN-KERF CIRCULAR TWIN HEADRIG

Forintek Canada Corp.
Eastern Region
Région de l'Est
Fax/Télécopieur (613) 744-0903

February 12, 1993

file: 3785K926

Mr. T. Felhaber
North American Sawmills Machinery
P.O. Box 89
Killaloe, ON
K0J 2A0

By FAX: (613) 757-3297

Dear Terry,

Just a follow-up to our meeting with yourselves and Bob McRae. As discussed, we agreed to the following:

1. Schedule

   You expect to complete and move the unit to McRae's by the first week in March. We will plan to have our people on site the weeks of March 8 and 15. Please advise if the schedule changes.

2. Saw Collars

   For thin kerf saws, the collars become a critical element. If possible, we recommend using a collar with a hardness of at least .40 - .45 RC and a machined taper of .003" maximum.

3. Guides

   North America will manufacture the guides according to the drawings provided under the license agreement. Wayne will discuss with Julien any questions or requirements.

4. Other

   - The V-track should have both vertical and horizontal adjustments for alignment purposes.
   - Bob McRae has ordered saws and they should arrive in time for the start up.
   - North American and McRae will buy or build a suitable lubricating system for the guides.

Great stuff. Looking forward to the start up.

Sincerely yours,

FORINTEK CANADA CORP.

William F. Love,
Manager
Lumber Manufacturing Technology

c.c. B. McRae

Forintek Canada Corp.

INTERNAL MEMORANDUM

April 5, 1993

file: 3785K926

To: W. Love

Fr: J. Pleau

Re: **Thin Kerf Implementation - McRae Lumber - Whitney, Ontario**

The overall objective of this project was for G. Veilleux and I to instruct and assist the sawmill personnel in the start-up of an overhead circular twin headrig, built by North American Sawmills Machinery Ltd.

The work conducted included the following:

Phase #1 from March 21 to March 26

1.0 Alignments of the transport system:

This overhead transport system is equipped with only one "V" track and three flat tracks.

Top and bottom "V" tracks mounted on one side of the system with two flat tracks on the opposite side are highly recommended to insure sawing accuracy.

A deviation in the "V" track was detected on the infeed side, about 5 feet from the saw section. Although this deviation will affect sawing accuracy, it was not possible for us to correct it since the two short ends of tracks that were used at this location were "butt welded" by the manufacturer. It is a known fact that short tracks of any kind should never be used OR WELDED on the infeed side of a carriage.

Other than this deviation of about 6" long at the infeed side of the overhead transport system, both dogs were adjusted to a maximum deviation of .005" for the full length of the tracks.

2.0 Alignments the two saw arbors:

2.1 Both arbors were adjusted level with a .020" lead for a 42" saw, facing the infeed side.

2.2 Difficulties were encountered to level both arbors. The bearings located at each end of the arbors were mounted on rough surface base plates (not machined). These were welded to the motors brackets with a twist of .080" from one base plate to the other.

2.3 Very limited planning was made by the manufacturer to provide access to adjust the bearings and the saw arbors.

Phase #2 from March 29 to April 1, 1993

3.0 Saw Guides Adjustments

3.1 The saw guides were not made to Forintek's drawings.

- Each guide weighs about 100 lbs and will be very difficult to handle at every saw change.

- Both stationary guides are fixed to the frame of the machine and do not provide any possibility to adjust each guide to the lead in the saw.

  Results - there is only one edge of each guide plug that is guiding the saws instead of a full 2 1/2" diameter.

- The design of the tubing arrangement to supply the flow of lubricant to the guide plugs will not be too effective.

- Copper tubing that are not even threaded or welded were used to connect the flow from the infeed to the base of the guide plugs. These can be removed with two fingers... (see pictures for additional details).

4.0 "Thin Kerf" Circular Saws Supplied by Hodgson Saws Ltd.

Due to the very poor manufacturing quality of these saws, it was not possible for us to even attempt to put them in operation.

Conclusion

Bob McRae decided to temporarily operate this system with inserted teeth saws, until he can find a more reliable saw manufacturer.

J.H. Pleau

c.c. Y. Corneau
G. Veilleux

Forintek Canada Corp.

INTERNAL MEMORANDUM

April 15, 1993
file: 3785K926

To: W. Love

Fr: J.H. Pleau / G. Veilleux

Re: **Thin Kerf Implementation - McRae Lumber - Whitney, Ontario**

Recommendations to improve operating conditions on their "Thin Kerf" overhead circular twin headrig

Problems	Solutions
Guide Assembly	
Too heavy to handle at every saw change.	Re-manufacture guide as per design so removable section weighs approx. 20 lbs.
Not adjustable for lead.	Must be mounted on a different base style to provide adjustment with saw line of cut and saw lead.
Inadequate guide plug lubrication system and protection.	Better protection of existing line hook-up. Connecting tubes from the nozzles to bottom of guide must be soldered or threaded at both ends. Nozzles must have "O" ring seals. Replace steel plug holding screws with brass screws.
Guide clearance for centre cant	Guide must be altered to allow manufacturing of 4" wide centre cants.
Saw Arbors	
Not easily accessible for alignment, maintenance or repair.	Plate over both arbors must be made removable for easy access and maintenance. Make or cut larger holes in the frame over both arbors for piano wire hook-up for alignment.
Not mounted on accurate surfaces.	The pillow blocks or bearings should be mounted on a flat machined surface.
Saw arbor bearings.	Adjustable self-aligning bearings should be used in such a set-up (lead adjustment).

Saw Collars

The saw collars are made out of mild steel.	We recommend changing to hardened collars when existing collars get damaged (do not meet the specification required).

Saws

Saws supplied by Hodgson Saws & Knife did not meet standards required for thin kerf sawing. Excessive variations in carbide side clearance and tooth angles. Wrong tooth profile.	Find another saw manufacturer that can deliver saws to reach thin kerf standards. International Knife & Saw Inc. are presently supplying Huard with more than acceptable saws.
Saw tensioning and levelling.	McRae's sawfiler needs additional training before he can properly maintain the saws for thin kerf sawing.

Carriage

Design:

The drive and carriage line of travel are offset (puts a side load on the single V-rail).

The system has only V rail (such system requires 4 extra axles and 8 extra wheels).

V and flat track system is poorly mounted on the inside of a structural channel (flat shims to level a taper surface)

General set up of track and carriage system not properly designed for maintenance and repair.

APPENDIX 2

PRECISION REQUIREMENTS TO ENABLE SUCCESSFUL CONVERSION TO A THIN-KERF CIRCULAR HEADSAW

PRECISION REQUIREMENTS TO ENABLE SUCCESSFUL CONVERSION TO A THIN-KERF CIRCULAR HEADSAW

by

J.H. Pleau
Technical Advisor

The following includes baseline assessment considerations and recommendations related to precision and mechanical modifications required to enable successful conversion of an existing circular headsaw to a "Thin-Kerf" operation.

Mill Foundation

The concentration of weight and the operation (movements) of the equipment must be considered to correctly determine the bracing requirements. In any case, the foundation and bracing members must be sufficient to provide rigid support for the mill machinery under every operating conditions that are likely to be encountered.

The Husk

The proper installation of the husk and its component parts is essential for safe, trouble-free saw operation and accurate sawing of lumber. The main components of the husk are the arbor(s), saw(s), saw guides, collars and the splitters.

Note: The husk must be levelled in all directions.

The Saw Arbor

The diameter of the arbor is relevant to the rotational speed of the saw and the amount of horsepower applied. The arbor must be capable of transmitting smooth, vibrationless rotation to the saw. Any vibration or distortion of the arbor is amplified at the rim of the saw, thus causing erratic performance.

The arbor must be stiff enough to withstand the torque loads of the power source and the shock loads resulting from the sawing process.

Three factors must be considered when selecting an arbor: (1) diameter, (2) rotational speed, and (3) the number and the type of bearings. It is preferable to select a larger diameter for greater arbor stiffness to reduce deflection and vibration and also increase the life of the bearings.

The Arbor Bearings

Low friction, self-aligning roller bearings are recommended. Two arbor bearings are generally used for arbors up to 6 feet in length. The recommended speed and load by the manufacturer should be closely followed.

The bearing next to the saw must be mounted as close to the stationary collar as possible to minimize arbor stiffness by decreasing the leverage placed on the bearing while sawing. Similarly, the pulley that transmits power to the arbor must be mounted as close to the husk as possible. If this pulley has to be mounted more than 24 inches from the husk, an additional outboard bearing must be installed.

The Saw Collars

New or "perfectly" refaced collars must be used. The stationary collar must be adjusted at a perfect 90° (± .000") with the arbor.

Tools and Materials

It will not be possible to achieve the accomplishment you are looking for unless you use some precision tools to adjust and align the sawmill.

Carpentry tools are fine for working with wood made by machines, but not for fixing machines that produce wood. A carpenter's level or square are just not accurate enough for setting up precision machines.

A machinist's level, for example, is not only more accurate than a carpenter's level, but the vial that holds the levelling bubble is calibrated so you can measure how much a track, a headblock or a saw arbor is off level. The use of a "string" to adjust the tracks to a straight line is not recommended since they are usually quite fuzzy and hard to measure and too weak to pull really tight. It is better to use a 40 to 60 pound test fishing line - or better yet a piano wire pulled tight by turnbuckles. A precision dial indicator and square are also needed in these operations.

Transport Systems Alignment

For a carriage headsaw

The track: Check the guide track for wear. The flanges of the carriage wheels should ride on the bevelled sides of the track and there should be a minimum clearance of 1/64-inch between the top surface of the track and the bottom surface of the "V" in the wheels. When these surfaces begin to make contact with one another, the carriage wheels will "float" on the guide track and the carriage will lose all its accuracy to cut straight lumber.

Locating the "V" track away from the saw lessens the chances of sawdust and bark from falling onto it and causing derailment; also, the carriage is less apt to derail by the action of the log turner.

The track should be laid so that the end of the headblock base clears the saw collar by about 1/2-inch.

Both the guide track and the flat track have to be perfectly straight, parallel and level for their entire length. Once the track alignment is completed, the triangulation to the saw arbor should be made and the required "saw-lead" adjusted.

The Carriage

The structure of the carriage should be heavy enough to withstand high accelerations and the expected shock loads. The headblocks should be fabricated from steel plates and rigidly braced and have accurately machined front and bottom faces. To obtain a smooth slippage and a good stability on the headblocks, replaceable steel wear strips mounted on the front faces and large wear resistant bronze pads mounted at the base of the headblocks should be used. These can be re-adjusted to take up the wear from the knee and also simplify maintenance procedures. The carriage "MUST" be equipped with enough headblock assemblies to adequately support and hold the logs in place.

For the carriage and track components to be maintained properly, the headblock and knee assemblies must be kept aligned; trucks must be kept free from end-play, setworks must be kept tight, dogs must be kept sharp and in good working order, and the track must be kept level and aligned.

Circular Twin Headrig

Transport systems:

Generally, the axe systems are known to be slow due to the long spacings and the fact that the axes are not too accurate since they do not have the ability to prevent the log from moving when it is engaged in the saws.

The sharp chain system, however, has the reputation of being more accurate but can only offer a limited piece-count due to the time spent at positioning. It should also be noted that the costs and the complexity of this system has to be evaluated against the size of the operation.

The most recent innovation in circular twin headrigs appears to be the recent introduction of an overhead end dogging system that is adequately designed for a thin-kerf operation. The system has already proven its efficiency both in high production levels and sawing accuracy.

Is the sawmill willing to invest a new transport system? Do they have the resource to increase production?

Forintek's Saw guide

This guide assembly is specifically designed for "Thin-Kerf" circular headsaws of large diameter and covers a compromise of several important and favourable performances.

The position of the top guide pads should be equal to 30 percent laterally to the saw radius and the front guide pads (closest to the saw's periphery) and should cover 10 percent of the saw's diameter, to minimize saw vibrations and maximize sawing accuracy.

That is why it is very important to adapt each saw guide assembly to the saw specifications - i.e. diameter; tooth pitch, gullet depth and saw thickness.

Saw Guide Lubrication System

The Forintek guide must be equipped with a lubrication system. Lubrication is required to minimize friction between the minimal clearance (.005") between the saw and the six guide plugs. A positive pressure should be maintained at the surface of the guide pads; this condition will develop some very significant load carrying capacity to insure the stability of the saw at relatively high feed rates. The greater the load carrying capacity, the higher are the forces that the saw can exert on the guide pads before contact is made, and heating is initiated by friction. Inexpensive lubrication systems are available from a variety of suppliers.

Saw Selection

The selection of a "thin kerf" large diameter circular headsaw should be based primarily on the hardest species and on the largest log diameter.

Example: with an 8-inch saw collar, a 44-inch saw can cut 18-inch logs. If occasional, much larger diameter logs have to be cut, a top saw needs to be installed.

Factors to be considered during saw selection:

Diameter, thickness, kerf, number of teeth and saw arbor R.P.M. These specifications apply to each individual operation requirements.

Horsepower Requirements

Horsepower requirements are determined by the gullet loading, the number of teeth, the saw arbor R.P.M., saw kerf and the depth of cut.

Note: Horsepower requirements must not be reduced more than 5% to maintain sawing accuracy.

APPENDIX 3

CHECKLIST TO HELP ACCESS POSSIBILITIES FOR CONVERSION TO A THIN-KERF CIRCULAR HEADSAW

CHECKLIST TO HELP ACCESS POSSIBILITIES
FOR CONVERSION TO A THIN-KERF CIRCULAR HEADSAW

The following is a baseline assessment of the existing operation, to be completed prior to the initiation of a project that would include the modification of a circular mill to a "Thin Kerf" operation.

1. Describe mill foundations:

   a) foundation members: wood_____ steel_____

   spacing between members_____

   b) available space for waste conveyors and chains:_____

   c) advise if the track and the husk are on separate foundations

   d) evaluate level of vibration: . track ____

   . husk ____

   Other comments:

2. Describe the installation of the husk:

a) its fabrication: steel_____ wood_____

b) the saw arbor: . length - check for level

. diameter - also dia. at saw position

. number of bearings

. type of bearings

. distance from stationary collar to the first bearing

. distance from the last bearing to the driven pulley

. use a dial indicator to detect any bents in saw arbor

. use a machinist to check saw arbor's level

Other comments:

3. The saw collars:

a) collar's diameter

b) the width of the surface that makes contact with the saw

c) measure the amount of taper of that surface

d) measure the diameter of the two lug pin holes - the distance from center to center

e) is the stationary collar fixed to a taper fit on the arbor, or a straight fit with 2 keyways at 180°?

Note: use a dial indicator to check deviations on stationary collar. If more than .003" per revolution, both collars need to be remachined or replaced.

Other comments:

4. The drive:

a) Diesel

b) Electric

c) Horsepower

d) R.P.M.

e) full description of drive and driven pulleys, distance between their centers, pulley, diameter, etc...

f) number of V-belts, check tension

Note: advise on belt maintenance procedures, see if worn grooves in pulley allows belts to ride in bottom of the grooves, if V-belts are always used as matched sets. See if there are some misalignments between pulleys, etc...

Other comments:

5. The track:

a) advise on the condition of the track

b) the V-track should be located away from the saw, confirm

c) measure the distance between the end of the headblock base and the saw collar -should be about 1/2"

d) give a description of the type of adjustments used to facilitate the track alignment

e) use a feeler gauge to measure the distance between the flat on the V-track and the flat at the bottom of the casters.

Other comments:

6. The carriage:

a) advise on the number of headblocks & length of the carriage

b) advise on the number of casters - also diameter

c) use a machinist level to check headblock base

d) check wear plates

e) check the knee and headblock base for 90° angle

f) check for trucks with end play

g) see if dogs are sharp and in good operating condition

h) check the knees for possible backlash.

Note: If possible, check crosslevel by loading a large log on the carriage, run the carriage slowly down the track and check level with a machinist level.

Other Comments:

7. General Information:

a) Production . species

. min. and max. log diameter and length

. production per hours shift .MBF
. no. of logs

. target size

. average sawing variations: within_____ between_____

b) Is the mill operating under a quality control system?

c) Have they got a preventive maintenance program? how effective is it?

d) Evaluation of personnel affected to the headrig:

. sawyer(s)

. filer(s)

. millwrights

e) Enumerate available equipment in the filing room that is related to the maintenance of "thin kerf" large diameter (44") head saws.

. is there a need for additional equipment? - describe.

f) See space available for the installation of the guide assembly -

The top surface of the guide assembly should be close to the center of the saw arbor.

Note: all possible vibrations "MUST" be eliminated in the immediate guide area.

J.H. Pleau